GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[X] ORIGINAL
[ ] REVISION NO. ____

Project No. A-3021 — DATE: 8/18/81

Project Director: R.W. Rice — ~~School~~/Lab ECSL/CSD

Sponsor: Oglethorpe Power Corp.

Type Agreement: Purchase Order #00006 dtd. 7/30/81

Award Period: From 7/30/81 To 8/30/81 (Performance) 8/30/81 (Reports)

Sponsor Amount: $4,525 — Contracted through:

Cost Sharing: N/A — GTRI/~~GIT~~

Title: Channel Occupancy Monitoring

ADMINISTRATIVE DATA — OCA CONTACT Faith G. Costello

1) Sponsor Technical Contact: James Green, Oglethorpe Power Corporation, 2888 Woodcock Blvd., Tulane Bldg. P.O. Box 105033 Atlanta, GA 30348

2) Sponsor Admin./Contractual Contact: See above

Reports: See Deliverable Schedule — Security Classification: N/A

Defense Priority Rating: N/A

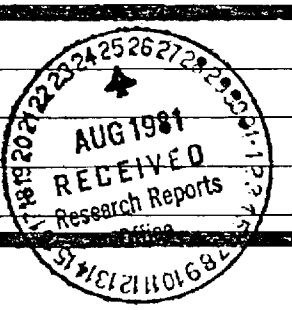
RESTRICTIONS

See Attached N/A Supplemental Information Sheet for Additional Requireme

Travel: Foreign travel must have prior approval - Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with N/A

COMMENTS:



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GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION SHEET

Date 9/16/81

Project Title: Channel Occupancy Monitoring

Project No: A-3021

Project Director: R. W. Rice

Sponsor: Oglethorpe Power Corporation

Effective Termination Date: 8/30/81

Clearance of Accounting Charges: 8/30/81

Grant/Contract Closeout Actions Remaining:

- [x] Final Invoice and ~~Closing Documents~~
- [ ] Final Fiscal Report
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other _____

Assigned to: ECSL/CSD (School/Laboratory)

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FORM OCA 10:781

Georgia Institute of Technology
ENGINEERING EXPERIMENT STATION
ATLANTA, GEORGIA 30332

August 28, 1981

Oglethorpe Power Corporation
2888 Woodcock Blvd.
Tulane Building
Atlanta, Georgia 30348

Attn: Mr. James Green
Manager, Power Delivery Services

Subject: Final Report on Project A-3021
Entitled "Channel Occupancy
Measurements"

Dear Mr. Green:

The objective of this effort was to make channel occupancy measurements on the 154.46375 MHz channel which is used for load management signaling at various locations in the state of Georgia. Originally, the intent was to make such measurements at the following locations:

(1) Marietta, GA,
(2) Moultrie, GA,
(3) Fitzgerald, GA,
(4) Snellville, GA, and
(5) Douglas, GA.

At your request, the measurement at Marietta, GA was deleted, and a site in Monroe, GA was substituted for the Snellville site.

The first measurements were made at the offices of Walton Electric Membership Cooperative in Monroe, GA on 31 July 1981. The equipment configuration used for channel occupancy measurements is shown in Figure

1. The intermediate frequency (IF) output of a VHF receiver was rectified and supplied as an input to a strip chart recorder. The sensitivity of the strip chart recorder was adjusted so that a received signal level of approximately 2 microvolts would cause full scale deflection of the strip chart pen. The speed of the strip chart paper was adjusted to allow reasonable time resolution given the constraint that continuous recording for approximately 30 minutes was desired. In general, a speed of 10 centimeters/minute was used. The strip charts produced at Monroe were turned over to Ms. Lena Hickman of your staff for further evaluation.

Occupancy measurements were made at Moultrie, GA, Fitzgerald, GA, and Douglas, GA as a part of a trip spanning 4 August and 5 August 1981. The equipment configuration used for these measurements is shown in Figure 2. This configuration, although different in form from the one presented in Figure 1, performs essentially the same task. Note that in this case, a carrier operated relay (COR) is used to activate the strip chart recorder. The strip charts produced at Moultrie, Fitzgerald, and Douglas were turned over to Ms. Lena Hickman.

In the course of performing the measurements described above, interest was expressed in developing a capability within OPC of making occupancy, frequency, and signal strength measurements. Georgia Tech was requested to identify the needed equipment for such measurements. Figure 3 presents an equipment configuration for occupancy monitoring. The basic elements of this system are an antenna, a receiver, and a strip chart recorder. The cost to implement this configuration is summarized below for single frequency and multiple frequency operation.

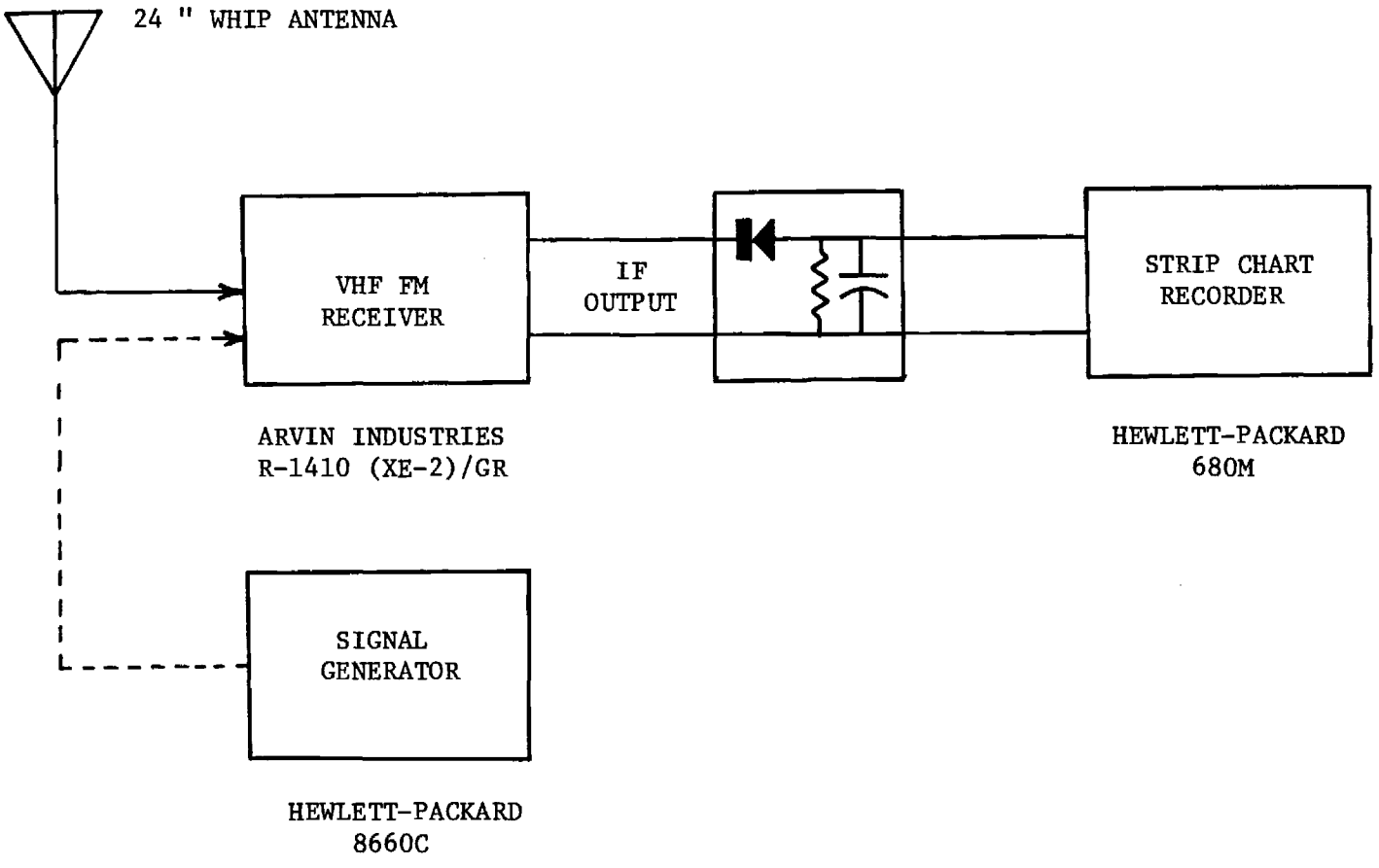

Figure 1. Equipment configuration for measurements at Monroe, GA.

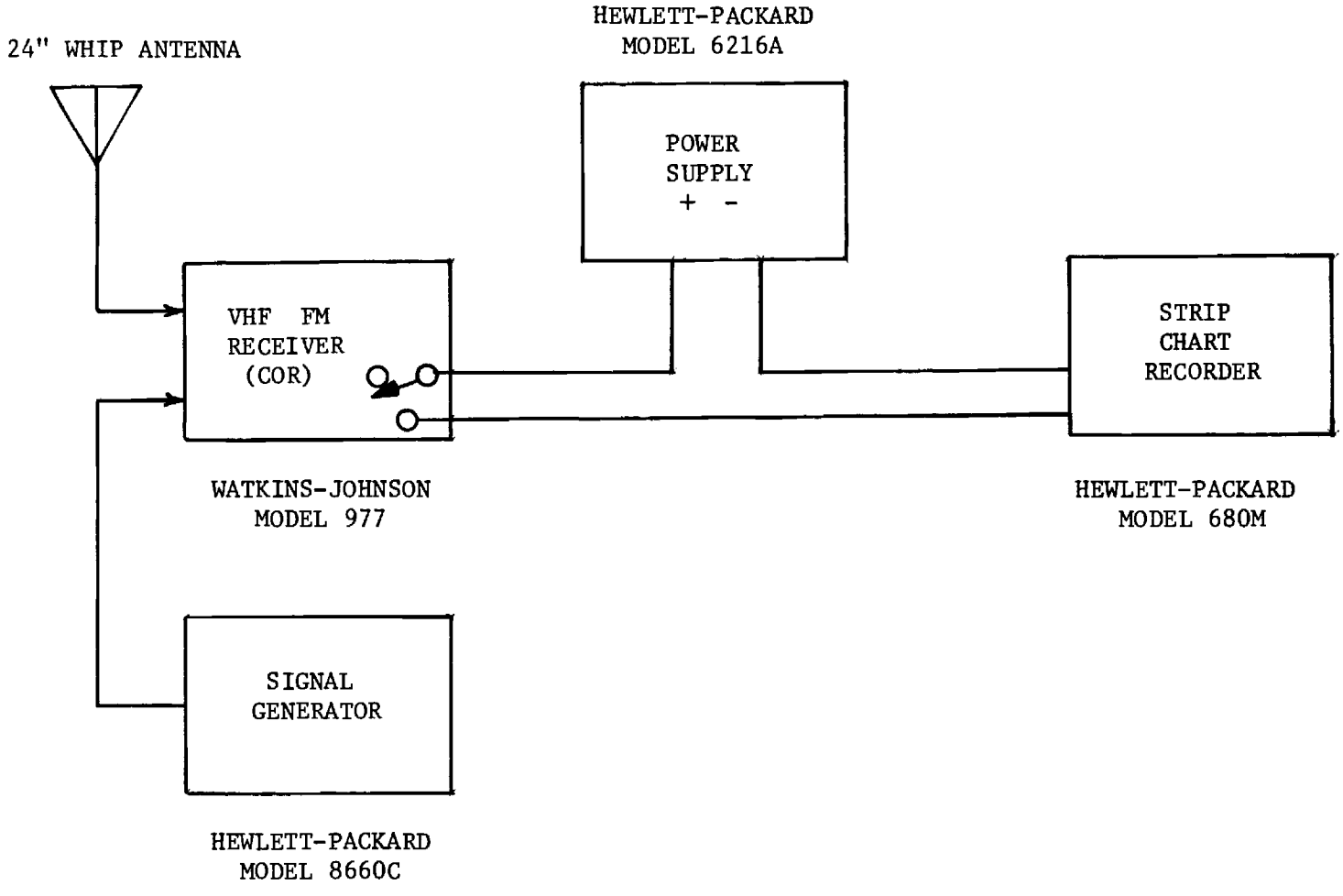

Figure 2. Equipment configuration for measurements at Moultrie, Fitzgerald, and Douglas, GA.

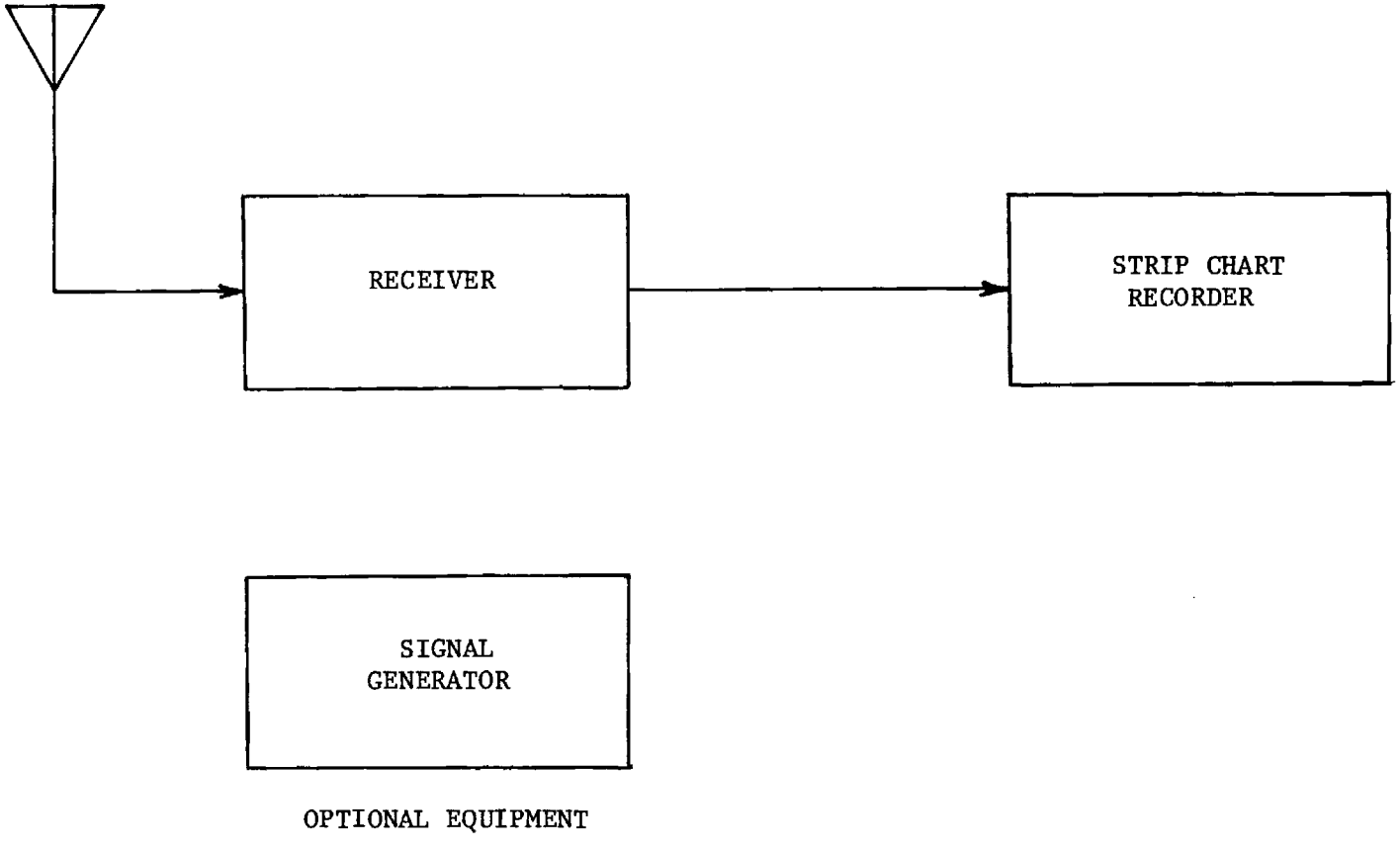

Figure 3. Equipment configuration for occupancy monitoring.

ITEM	SINGLE FREQUENCY MONITORING	MULTIPLE FREQUENCY MONITORING
ANTENNA (SIMPLE WHIP)	$ 50	$ 50
RECEIVER (WJ-441-5-2)	$3,500	
(WJ-565/VH-103)		$14,000
STRIP CHART RECORDER (HP-680)	$1,500	$ 1,500
	$5,050	$15,550

Shown in Figure 3 as optional equipment is a signal generator. This item can be used with a tunable receiver to accurately set the receiver's frequency and it can be used to calibrate the received signal levels. A unit suitable for this application is the Hewlett-Packard (HP) model 8654B oscillator used with the Hewlett-Packard model 5382A frequency counter. The cost of this combination is $3400.

A configuration suitable for field strength measurements is presented in Figure 4. Determination of received field strength using the set-up in Figure 4 is a two step process. First, the relative signal strength of the signal as indicated on the signal level meter is noted. Next, the signal generator is connected to the receiver, and its output is adjusted to produce the same relative signal level. Given the calibrated output level of the signal generator and the known characteristics of the antenna, it is then possible to determine the field intensity of the signal being observed.

The previously described receivers and signal generator are suitable for field intensity measurements; however, it is necessary to utilize a calibrated antenna in this application. One unit suitable for this application is the Scientific-Atlanta model 15-115. The cost of this unit is $2260.

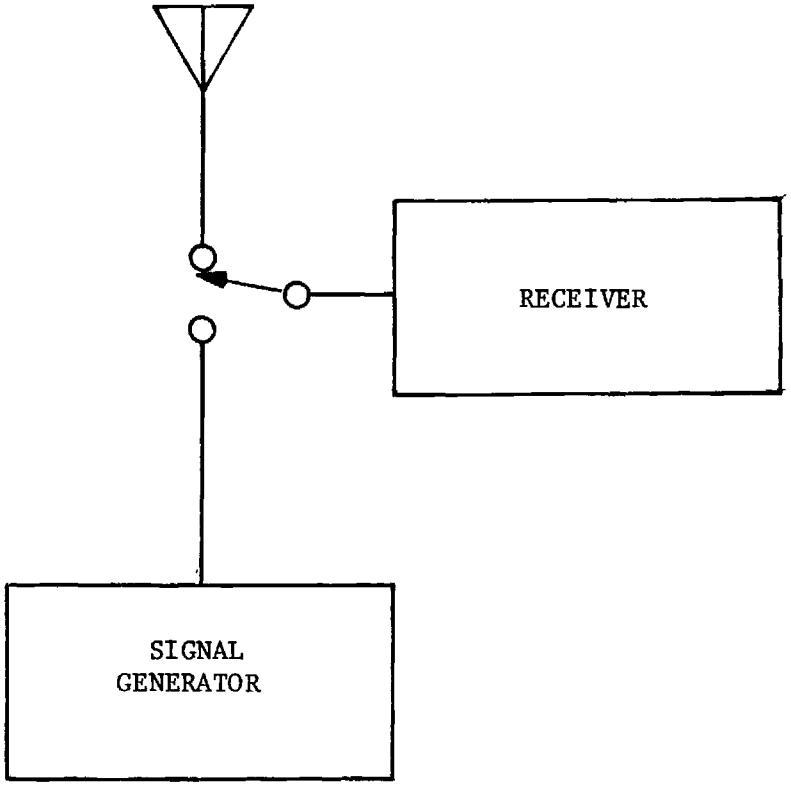

Figure 4. Equipment configuration for field strength measurements.

There are various ways to measure the frequency of radio signals. A simple approach is to connect a frequency counter to the transmitter in question or to place an antenna on the frequency counter and place the counter close to the transmitter. The previously described frequency counter (HP 5382A) is appropriate for either of these approaches.

Another approach to frequency measurement involves measuring the frequency of the received signal as it appears at the output of a receiver's intermediate frequency (IF) amplifier. This approach may be used with the multiple frequency receiver (WJ-565/VH-103) since this receiver provides an external connection to the IF stage. In this approach, the frequency counter would be connected to the IF output. The HP 5382A counter may be used in this fashion. It should be pointed out that to get highly accurate measurements using this technique, one must also know the frequency of the receiver's local oscillator. The WJ-565/VH-103 accommodates this by providing a local oscillator output which may be used to accurately measure the local oscillator frequency.

It has been my pleasure to work with the various OPC personnel on this project. Should OPC have additional needs in the area of communications system design/evaluation, I trust that OPC and Georgia Tech can work together to meet these needs.

Respectfully,

Robert W. Rice, Ph.D.
Senior Research Engineer

RWR:ame
cc: R.W. Moss